

**FINAL MONITORING PLAN
CAPITOL LAKE MILFOIL CONTROL PROJECT
PRE- AND POST- TRICLOPYR APPLICATION MONITORING
JUNE 2004**

As part of the application of the herbicide triclopyr, for Eurasian watermilfoil control in Capitol Lake, the Department of General Administration will ensure that monitoring is performed. The goal is to secure adequate data to determine the effectiveness of the treatment, the dissipation of the triclopyr, and the impact of dying and decaying milfoil plants on water quality. Project monitoring will be a coordinated effort by the Washington departments of Ecology and Agriculture, Thurston County, City of Olympia, Port of Olympia and LOTT Wasterwater Alliance. The plan incorporates existing monitoring efforts, as well as additional activities to obtain sufficient data to monitor the project. The 2004 milfoil control project includes an application of the herbicide triclopyr in the south and middle basins of Capitol Lake on July 19, and a second application in the north basin on July 29.

The type of monitoring to be done includes the following:

- “Frequency of Occurrence” sampling of the aquatic plant community – pre- and post- treatment
- Biomass sampling of aquatic plant community – pre- and post-treatment
- Dissolved Oxygen sampling – pre- and post-treatment
- pH sampling – pre- and post-treatment
- Triclopyr sampling of lake and marine water - pre- and post-treatment
- Triclopyr sampling of lake sediments - pre- and post-treatment
- Triclopyr sampling of groundwater - pre- and post-treatment

Macrophyte Survey Frequency of Occurrence and Plant Biomass Sampling

The purpose for the macrophyte survey monitoring is to determine the effectiveness of the herbicide treatment on control of milfoil and the response of the native aquatic plant community in the lake. A macrophyte survey will be conducted once prior to the herbicide treatment in late June or early July 2004, and repeated twice after the herbicide treatment, at four to six weeks (early to mid-September 2004) and one year (mid to late July 2005).

The macrophyte surveys will include analysis of the frequency of occurrence of plant species throughout the lake and a measure of the plant biomass. The work will be done using standard protocols described in Washington Department of Ecology Publication Number 01-03-017 (“Aquatic Plant Sampling Protocols”, J. Parsons, 2001).

As part of the Deschutes Total Maximum Daily Loading Study, Ecology will conduct the pre-treatment survey. Thurston County will perform the two post-treatment surveys following the same protocol used for the pre-treatment survey.

Dissolved Oxygen and pH Monitoring

Dissolved oxygen (DO) and pH monitoring will be conducted before, during and after herbicide treatment to check for potential effects of the milfoil die-off and decomposition.

In-Lake Sampling

Pre-treatment and post-treatment conditions will be monitored in several areas.

Monthly ambient monitoring: As part of routine ambient monitoring, Thurston County will take instantaneous measurements of DO and pH in May and October at a sites in the middle and north basins. Ecology will take instantaneous DO measurements at three sites in the lake in June, July, August, and September as part of the Total Maximum Daily Load Study currently be done for the Deschutes River. In addition, the DO concentration in the deep area near the Capitol Lake Dam siphon will be measured in June and during pre-treatment sampling to determine if anaerobic or aerobic conditions exist.

Continuous monitoring: Ecology will install a DO and pH recording instrument in the lake near the outlet for a week prior to the treatment. Ecology will keep the instrument in the lake for the two-week period during the first and second herbicide applications, and for one week after the second herbicide application has been completed.

Intensive monitoring: Thurston County will measure DO concentrations and pH for three 24-hour periods at a site within the treatment area in the middle basin after the first herbicide treatment. The greatest measurable effect on dissolved oxygen in the lake would likely be in areas of dense milfoil, which is in the off-channel areas of the middle basin. The first sample event will occur when the milfoil plants begins to drop out of the water column, which is anticipated to be approximately five days after the herbicide treatment. The second and third events will be in weeks two and three after treatment in the middle basin. In addition, pH and DO will be measured during the day 0 and day 1 triclopyr sampling events described in the section below.

Marine Water Sampling

GA will rely on existing monthly and bi-monthly monitoring programs in Budd Inlet for marine water dissolved oxygen.

Ecology conducts ambient monitoring at one site in Budd near the Olympia Shoal (B005) once per month. The sampling includes profile sampling for dissolved oxygen and nutrient and chlorophyll a samples. The contact person for Ecology marine water sampling is Julie Bos or Brian Grantham at 407-6674.

The LOTT wastewater treatment plant staff monitors dissolved oxygen at five sites in Budd Inlet twice per month as a requirement of the NPDES discharge permit. The sample site locations are as follows: Capitol Lake Outfall, near Fiddlehead marina, over the LOTT treatment plant outfall, near East Bay Marina, and Buoy 6.

Triclopyr Sampling

The purpose of this monitoring is to measure triclopyr concentrations within the treatment areas and its dissipation and migration out of these areas. General Administration will close the Capitol Lake Dam (tidegate) for as long as possible after each herbicide treatment. The goal is to keep the dam closed for 3 days, but will depend on the volume of water coming into the lake from the Deschutes River.

Surface Water

Prior to the first treatment, water samples will be collected within the treatment areas in the north and the middle basins, near the lake outlet, off the Port of Olympia guest dock and Priest Point. This will be done to determine if background levels of triclopyr exist prior to the treatment. Triclopyr is a commonly-used herbicide in the forest industry, and for roadside vegetation control.

Post-treatment sampling frequency will generally be at 0 day, 1 day, 3-5 days, 6-7 days, and 14 days following each of the two treatments. The sites monitored during each event will follow an adaptive principle, where initial samples following treatment will be collected within the treatment areas and relatively close downstream (to the north). As time progresses following the application and results show decreasing or undetectable concentrations of triclopyr, the sampling sites will be moved north to track possible migration of the herbicide with the water movement.

The number of sample sites during any given sampling event may be up to 10 sites. After the first application in the middle basin, sample sites will include 4 samples in dense plants beds within the treatment area (south and middle basins), one sample at the railroad crossing at the mouth of the middle basin, two within the planned treatment area in the north basin, and one near the lake outlet. The specific in-lake sampling sites will be selected based on a map prepared by the applicator showing the areas of the lake where the herbicide was actually applied, and based upon flow patterns within the lake described in previous consultant-prepared reports (See general circulation map on page 4). While the lake outlet is closed, only sites within the lake will be sampled. The sampling will be timed so that the results from the first four sampling events will be received prior to the second application.

When the lake outlet is reopened, Budd Inlet sites will be sampled the following day, and then sampling frequency will resume as planned for the remainder of the events. Samples in Budd Inlet will be collected from a depth of 2 feet below the surface to maximize collection of freshwater from the lake.

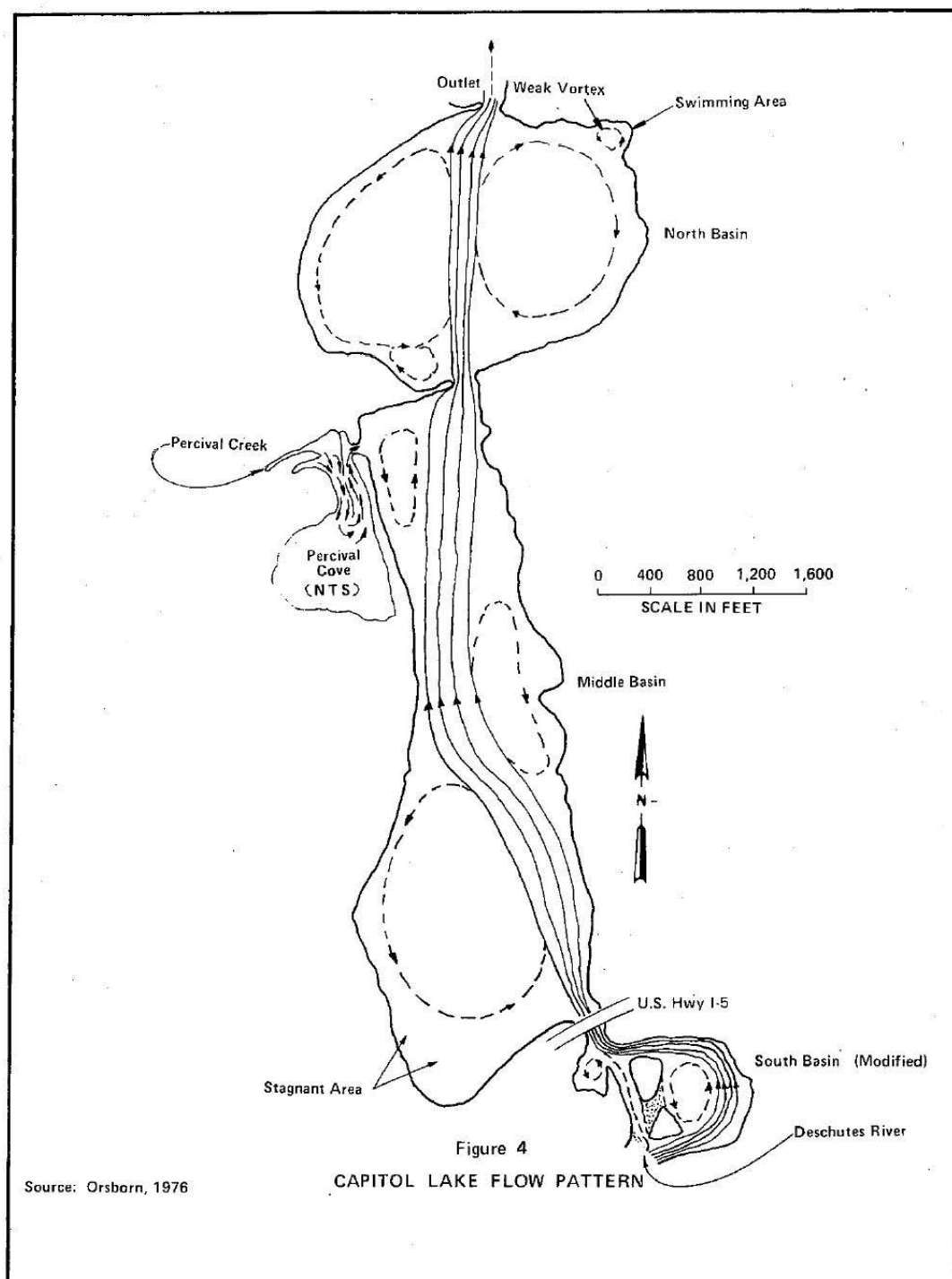
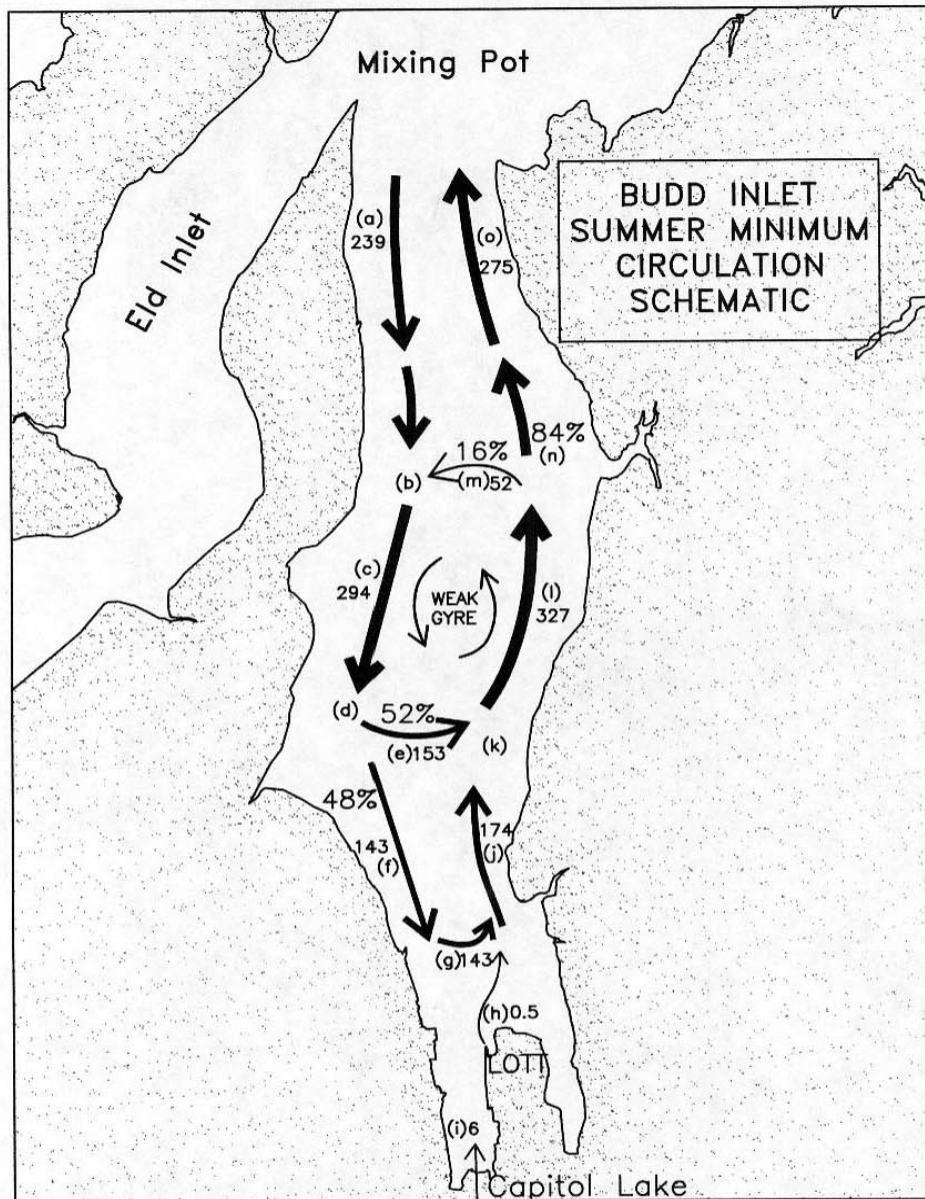


Figure 3-31. Schematic Plan View of Budd Inlet Water Circulation during August 1997



The arrows indicate water flow scaled with thickness approximately proportionate to net volume transport (m^3/s). Refluxing is shown by the percentages of the main flows diverted east and west across the inlet forming the weak gyre in the Central Inlet. Letter codes (a - o) following the water flow clockwise around the inlet denote the following: (a) from the mixing pot the Outer Inlet main inflow transports southward $239 \text{ m}^3/\text{s}$ as a submerged jet-like current hugging the western shore of the Outer Inlet; (b) Outer Inlet main inflow merges with water refluxed from the outflow in the Central Inlet; (c) main inflow in the Central Inlet equals $294 \text{ m}^3/\text{s}$ comprised of 82% water from the Outer Inlet ($239 \text{ m}^3/\text{s}$) and 18% water refluxed from the Central Inlet main outflow ($52 \text{ m}^3/\text{s}$); (d, e) Central Inlet main inflow diverges with approximately half (48%; $143 \text{ m}^3/\text{s}$) flowing into the Inner Inlet, and half refluxing (e; 52%; $153 \text{ m}^3/\text{s}$) around the Central Inlet gyre; (f) Inner Inlet main inflow ($143 \text{ m}^3/\text{s}$) moves southward to the vicinity of the LOTT outfall; (g, h, i) Inner Inlet main inflow merges with discharges from LOTT (h) and Capitol Lake (i); (j) Inner Inlet main outflow ($174 \text{ m}^3/\text{s}$) exits primarily as a thin layer a few meters thick; (k) Inner Inlet main outflow merges with water refluxed from the Central Inlet main flow; (l) Central Inlet main outflow in a thin layer a few meters thick ($327 \text{ m}^3/\text{s}$) flows around the east side of the gyre; (m, n) Central Inlet main outflow diverges (n) with a secondary fraction (m; 16%; $52 \text{ m}^3/\text{s}$) refluxing westward into the Central Inlet main inflow (b, c); and (o) Outer Inlet main outflow ($275 \text{ m}^3/\text{s}$) exits northward to the mixing pot.

Ref.: Budd Inlet Scientific Study, Final Report, August 1998, ANOVA Consultants, et al.

The four anticipated marine sample locations include sites off the Port of Olympia guest dock, off the Port peninsula, off Priest Point, and mid-way up the Inlet along the east shoreline (off approximately the 4600 block). These sites were selected based on information in the Budd Inlet Scientific Study, Final Report (August 1998), which shows that these sites are in the flow path of freshwater discharging from Capitol Lake (See map on previous page). Sampling will be conducted by boat with Port of Olympia or LOTT staff assistance.

For monitoring of the second application in the north basin, initial sampling will include 3 sites in plants beds within the treatment area, one in the center of the north basin, and one near the lake outlet. When the lake outlet is reopened, Budd Inlet sites will be sampled the following day, and then sampling frequency will resume as planned for the remainder of the events. One sampling event for the second application will likely coincide with the day-14 sampling event for the first application. In that case, one set of samples will serve both purposes.

Sediment Sampling

Sediment samples will be collected to determine to what extent triclopyr becomes embedded in the lake sediments (expected half life is ~8 days). Sediment sampling will be done once prior to the application to establish background levels. A post-treatment sampling will be done approximately one month after the last application, with a contingency to sample a second time in the event sediment concentrations exceed anticipated levels. There will be 4 composite samples collected from within treatment areas using a Petite Ponar dredge.

If it is determined that anaerobic conditions exist within the deep area near the lake outlet, a sediment sample will be collected from there.

Ground Water Sampling

One existing monitoring well in the block between 4th and 5th Avenues and Water and Sylvester Streets will be sampled for triclopyr. The depth of the monitoring well is less than 20 feet, and the water level is about 6 feet. City of Olympia staff will collect a pre-treatment sample, and a post-treatment sample approximately one month after treatment.

The purpose of this sampling is determine whether treated water from Capitol Lake migrated through the shallow saturated zone and fill material under 4th and 5th Avenues toward Budd Inlet.

Analytical Lab

The samples for triclopyr will be analyzed using EPA method SW 8151A. The analysis will be performed by a lab accredited by Ecology. The method detection limit for this project for triclopyr in water will be at least 0.1 ug/l and in sediment between 0.01 and 0.1 mg/l.

Project Data Management and Interpretation

Thurston County staff will coordinate the monitoring, and compile and report the sampling results to the General Administration. General Administration will use the information to manage and modify the herbicide application as necessary, determine effectiveness, and monitor effects.

Milfoil Control Project Monitoring Budget

2004 Post Treatment Macrophyte Survey - \$ 5,099.04

Staff Time:

118 hours * avg per hour staff rate \$42.07 = \$ 4964.04
Equipment use i.e., (boat, truck, misc.) = \$ 135.00

Total 2004 Cost = \$ 5,099.04

	2004 Post Treatment	2005 Post Treatment
Macrophyte Survey	\$ 5,099.04	\$ 5353.99

Note: Persons used will be based on availability. These costs are estimates, actual work performed will replicate DOE's Pretreatment Survey. Actual hours spent will be billed at the above per hour rates.

Dissolved Oxygen and pH Monitoring - \$1531

three sampling events @ 8 total hours per event

Triclopyr Sampling - \$20,226

Staff Cost - \$4396

Surface Water Sampling

6hrs/event * 9 events * \$53.80/hr rate = \$2905

Sediment Sampling

8 hrs/event * 3 events * \$53.80/hr rate = \$1291

Groundwater Sampling

To be done by City of Olympia staff = 200

Total Analytical Lab Costs - \$15480

Surface Water Samples: \$13320

5 sampling events after each of 2 herbicide applications * 5 sites (& 5 supplemental sites) AND 5 pre-treatment samples PLUS 6 QA/QC samples * \$120/sample

Ground water sample (pre- and post-sample): \$240

2 events * 1 site * \$120/sample

Sediment samples: \$1920

3 events * 4 sites * \$160/sample

Sample Shipping \$350

Project Data Management and Interpretation - \$2,152

40 hrs * 53.80/hr

TOTAL 2004 PROJECTED MONITORING COSTS - \$29,008

TOTAL 2005 PROJECTED MONITORING COSTS - \$ 5,354